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AERODYNAMIC LOADING CHARACTERISTICS OF A
1/10-SCALE MODEL OF THE THREE-STAGE SCOUT VEHICLE AT
MACH NUMBERS FROM 1.57 TO 4.65

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SUMMARY

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An investigation has been conducted in the Langley Unitary Plan wind tunnel to determine the aerodynamic loading characteristics of a 1/10-scale model of a three-stage Scout vehicle at Mach numbers from 1.57 to 4.65.

For the angles of attack investigated the data indicate that, in general, the major portion of the normal force is provided by the nose cone and the flared sections. However, for an angle of attack of 8° at Mach numbers of 3.96 and 4.65 most of the normal force is provided by the aft cylindrical section.

The normal-force and pitching-moment coefficients obtained by integration of the pressure distributions are generally in good agreement with those from a force investigation previously reported.

INTRODUCTION

The solid-propellant NASA Scout research vehicle is designed to perform a variety of research missions, including high-altitude probing and payload orbiting. It may be launched as either a three- or a four-stage vehicle, depending on the mission requirements.

As part of the Scout research program, an investigation was conducted in the Langley Unitary Plan wind tunnel to determine the distribution of the aerodynamic loads on a 1/10-scale model of a three-stage configuration. The tests were performed at angles of attack of 0° , 4° , and 8° and at Mach numbers from 1.57 to 4.65.

Data obtained from other investigations of three-stage Scout models are available in references 1 to 3.

SYMBOLS

The coefficients of forces and moments are referred to the body axis system with the pitching-moment reference point located on the model center line 15.40 inches forward of the base.

$$C_m \quad \text{pitching-moment coefficient, } \frac{4l^2}{\pi D_{ref}^2} \int_0^1 C_{n,f} \frac{D}{D_{ref}} \frac{x_2 - x_1}{l} d\left(\frac{x}{l}\right)$$

$$C_N \quad \text{normal-force coefficient, } \frac{4l}{\pi D_{ref}} \int_0^1 C_{n,f} \frac{D}{D_{ref}} d\left(\frac{x}{l}\right)$$

$$C_n \quad \text{body transverse-section normal-force coefficient, } \int_0^1 (C_{p,L} - C_{p,U}) d\left(\frac{y}{r}\right)$$

$$C_p \quad \text{local pressure coefficient, } \frac{p_l - p_\infty}{q}$$

D local body diameter, in.

D_{ref} reference diameter (diameter of second-stage cylinder), 3.10 in.

l length of model, 48.58 in.

M free-stream Mach number

p_∞ free-stream static pressure, lb/sq ft

p_l local static pressure, lb/sq ft

q free-stream dynamic pressure, $0.7pM^2$, lb/sq ft

R nose radius, in.

r local body radius, in.

x_1 distance from nose apex to local body station, in.

x_2 distance from nose apex to moment reference center, in.

y lateral distance of orifice from model center line, in.

α angle of attack, referred to body center line, deg

θ circumferential angular location of pressure orifice, $\theta = 0^\circ$ at top of model, deg

Subscripts:

L lower surface

U upper surface

MODEL AND APPARATUS

A drawing and a photograph of the model are presented as figures 1 and 2, respectively. The sting-mounted model had a single row of pressure orifices along its entire length, which could be positioned at any desired angular location by rolling the model.

A boundary-layer transition strip composed of No. 60 carborundum grains embedded in plastic adhesive was placed approximately 2 inches aft of the nose apex.

The investigation was conducted in both the low and the high Mach number test sections of the Langley Unitary Plan wind tunnel, which is of the variable-pressure, return-flow type. The test sections are 4 feet square by approximately 7 feet in length. The nozzles leading to the test sections are of the asymmetric, sliding-block type, which permits a continuous variation of Mach number from about 1.5 to 2.9 and 2.3 to 4.7 in the low and the high Mach number test sections, respectively.

TESTS

The investigation was conducted at angles of attack of 0° , 4° , and 8° , and at orifice angular locations of 0° (top of model), 30° , 60° , 120° , 150° , and 180° .

The average values of the test conditions were as follows:

Mach number	Stagnation pressure, lb/sq in. abs	Dynamic pressure, lb/sq ft	Reynolds number per foot	Stagnation temperature, °F
1.57	18.4	1,126	4.96×10^6	125
1.90	20.7	1,123	4.97	125
2.16	23.0	1,079	4.92	125
2.29	17.8	765	3.38	150
2.96	25.4	648	3.38	150
3.96	44.2	485	3.30	175
4.65	60.8	380	3.30	175

The dewpoint, measured at stagnation pressure, was maintained below -30° F to assure negligible condensation effects.

RESULTS AND DISCUSSION

A complete tabulation of the pressure coefficients is presented in table I. Figure 3 shows the longitudinal variation of the pressure coefficient at $\alpha = 0^{\circ}$ for each of the test Mach numbers. As would be expected, positive pressure coefficients are obtained in the regions of the model where the cross-sectional area is diverging - that is, the nose and the two flared sections. The data show that the greater the cross-sectional divergence, the greater the pressure coefficient. In parallel to this trend, the cylindrical portions of the body following the expansion shocks at the aft end of the nose and flared sections afford negative pressure coefficients and, as before, the greater magnitudes are associated with the greater divergence angle. Mach number has a significant effect on the magnitude of the pressure coefficients in both these model regions in that the higher absolute values of pressure coefficient occur at the lower Mach numbers. At the lower test Mach numbers the peak values of C_p for the flares are obtained at their forward ends, whereas at the higher Mach numbers the peak values occur at their aft ends. This rearward movement of the flare maximum-pressure region with increasing Mach number is believed to be due to the Mach number effect on the point of flow separation forward of the flare-cylinder juncture. As may be noted in figure 3, the effect of Mach number on the pressure coefficients of the cylindrical sections diminishes with increasing x_1/l and, for that portion of the aft cylinder from $\frac{x_1}{l} = 0.45$ to $\frac{x_1}{l} = 0.90$, the Mach number effect is very small.

The transonic data of reference 1 indicate similar effects of Mach number and diverging cross-sectional area on pressure coefficient although, as expected, the peak pressure coefficients at the transonic speeds are of considerably greater magnitude.

Figure 4 presents the longitudinal variation of the parameter $(c_n)(D/D_{ref})$ for angles of attack of 4° and 8° . For the angles investigated the data indicate that, in general, the major portion of the normal force is provided by the nose cone and the flared sections. However, for $\alpha = 8^{\circ}$ at Mach numbers of 3.96 and 4.65 the major portion of the normal force is provided by the aft cylindrical section of the model. Section normal-force coefficients are not presented for $M = 2.16$ because of insufficient data.

The plots presented in figure 4 were integrated (see section entitled "Symbols") to obtain the normal-force and pitching-moment coefficients. The results of these integrations are presented in figure 5, together with the results of the force investigation of reference 3. In general, the pressure data are in good agreement with the force data.

CONCLUSIONS

An investigation has been conducted to determine the aerodynamic loading characteristics of a 0.10-scale model of a three-stage Scout vehicle at Mach numbers from 1.57 to 4.65. The results indicate the following:

1. In general, the major portion of the normal force is provided by the nose cone and the flared sections; however, for an angle of attack of 8° at Mach numbers of 3.96 and 4.65 most of the normal force is provided by the aft cylindrical section.
2. The normal-force and pitching-moment coefficients obtained by integration of the pressure distributions are generally in good agreement with those from a force investigation previously reported.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., May 3, 1963.

REFERENCES

1. Kelly, Thomas C.: Aerodynamic Loading Characteristics at Mach Numbers From 0.80 to 1.20 of a 1/10-Scale Three-Stage Scout Model. NASA TN D-945, 1961.
2. Kelly, Thomas C.: Transonic Wind-Tunnel Investigation of the Static Longitudinal Aerodynamic Characteristics of Several Configurations of the Scout Vehicle and a Number of Related Models. NASA TN D-794, 1961.
3. Jernell, Lloyd S.: Investigation of the Static Longitudinal and Lateral Stability Characteristics of a 0.10-Scale Model of a Three-Stage Configuration of the Scout Research Vehicle at Mach Numbers of 2.29, 2.96, 3.96, and 4.65. NASA TN D-711, 1961.

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE

(a) $M = 1.57$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.5519						.024
.035	.1742						.035
.055	.3118						.055
.065	-.1924						.065
.076	-.1526						.076
.091	-.1126						.091
.101	-.0895						.101
.112	-.0728						.112
.122	-.0599						.122
.132	-.0484						.132
.153	-.0355						.153
.173	-.0304						.173
.184	-.0046						.184
.194	.1330						.194
.204	.1175						.204
.215	.1072						.215
.235	.0918						.235
.256	.0815						.256
.276	.0789						.276
.287	-.0420						.287
.297	-.0869						.297
.307	-.0754						.307
.318	-.0651						.318
.328	-.0573						.328
.338	-.0471						.338
.348	-.0394						.348
.353	-.0370						.353
.369	-.0357						.369
.379	-.0304						.379
.400	-.0292						.400
.441	-.0147						.441
.451	-.0133						.451
.482	-.0107						.482
.647	.0091						.647
.729	-.0028						.729
.812	-.0015						.812
.863	-.0028						.863
.904	.1289						.904
.945	.0828						.945
.987	.0591						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(b) $M = 1.57$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.5474	1.5433	1.5377	1.5460	1.5417	1.5385	.024
.035	.0569	.0776	.1443	.2029	.2998	.3231	.035
.055	.2354	.2438	.2717	.3235	.3739	.3875	.055
.065	-.2237	-.2241	-.2088	-.1864	-.1590	-.1546	.065
.076	-.1829	-.1819	-.1722	-.1488	-.1208	-.1121	.076
.091	-.1357	-.1359	-.1306	-.1136	-.0850	-.0761	.091
.101	-.1064	-.1065	-.1054	-.0897	-.0670	-.0580	.101
.112	-.0822	-.0848	-.0890	-.0809	-.0594	-.0503	.112
.122	-.0643	-.0681	-.0777	-.0735	-.0555	-.0451	.122
.132	-.0477	-.0515	-.0651	-.0608	-.0466	-.0362	.132
.153	-.0311	-.0337	-.0486	-.0496	-.0364	-.0297	.153
.173	-.0273	-.0323	-.0462	-.0457	-.0364	-.0297	.173
.184	.0326	.0265	-.0209	-.0345	-.0287	-.0194	.184
.194	.1206	.1172	.1153	.1175	.1323	.1441	.194
.204	.1002	.1006	.1002	.1100	.1259	.1364	.204
.215	.0875	.0878	.0901	.1024	.1221	.1313	.215
.235	.0658	.0673	.0724	.0873	.1119	.1235	.235
.256	.0530	.0533	.0649	.0811	.1068	.1184	.256
.276	.0466	.0469	.0611	.0785	.1081	.1197	.276
.287	-.0732	-.0745	-.0562	-.0383	-.0147	-.0066	.287
.297	-.1064	-.1001	-.1004	-.0847	-.0645	-.0568	.297
.307	-.0924	-.0899	-.0927	-.0784	-.0568	-.0503	.307
.318	-.0758	-.0771	-.0814	-.0684	-.0479	-.0413	.318
.328	-.0668	-.0707	-.0751	-.0647	-.0479	-.0374	.328
.338	-.0579	-.0605	-.0651	-.0596	-.0402	-.0310	.338
.348	-.0489	-.0515	-.0574	-.0521	-.0313	-.0219	.348
.353	-.0442	-.0471	-.0533	-.0551	-.0312	-.0185	.353
.369	-.0389	-.0444	-.0495	-.0551	-.0298	-.0198	.369
.379	-.0336	-.0404	-.0430	-.0434	-.0272	-.0158	.379
.400	-.0310	-.0351	-.0366	-.0408	-.0298	-.0172	.400
.441	-.0153	-.0192	-.0288	-.0343	-.0245	-.0092	.441
.451	-.0126	-.0179	-.0301	-.0356	-.0245	-.0080	.451
.482	-.0126	-.0166	-.0236	-.0291	-.0178	-.0053	.482
.647	.0058	-.0046	-.0068	-.0058	.0088	.0196	.647
.729	.0005	-.0060	-.0107	-.0123	-.0005	.0065	.729
.812	-.0047	-.0113	-.0133	-.0187	-.0072	.0117	.812
.863	-.0060	-.0113	-.0146	-.0201	-.0045	.0104	.863
.904	.1383	.0881	.1264	.1267	.1366	.1457	.904
.945	.0661	.0656	.0669	.0786	.1019	.1077	.945
.987	.0504	.0563	.0514	.0488	.0886	.1024	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(c) $M = 1.57$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.5292	1.5197	1.5087	1.5320	1.5203	1.5130	.024
.035	-.0341	-.0145	.0991	.2471	.4674	.5090	.035
.055	.1788	.1721	.2296	.3203	.4495	.4719	.055
.065	-.2459	-.2549	-.2351	-.1871	-.1190	-.1024	.065
.076	-.2061	-.2089	-.1984	-.1492	-.0733	-.0538	.076
.091	-.1510	-.1577	-.1693	-.1277	-.0440	-.0244	.091
.101	-.1073	-.1220	-.1452	-.1151	-.0300	-.0103	.101
.112	-.0752	-.0938	-.1363	-.1125	-.0300	-.0091	.112
.122	-.0547	-.0733	-.1225	-.1125	-.0300	-.0103	.122
.132	-.0381	-.0554	-.1136	-.1050	-.0262	-.0052	.132
.153	-.0239	-.0401	-.0971	-.1062	-.0288	-.0091	.153
.173	-.0201	-.0401	-.0845	-.1050	-.0377	-.0129	.173
.184	.0403	.0404	-.0553	-.0911	-.0338	-.0091	.184
.194	.1301	.0877	.0827	.0654	.1328	.1624	.194
.204	.1006	.0749	.0637	.0729	.1328	.1572	.204
.215	.0864	.0608	.0536	.0654	.1303	.1560	.215
.235	.0595	.0379	.0371	.0616	.1328	.1534	.235
.256	.0415	.0251	.0257	.0540	.1354	.1572	.256
.276	.0389	.0213	.0232	.0515	.1404	.1611	.276
.287	-.0701	-.0913	-.0870	-.0583	.0132	.0319	.287
.297	-.1368	-.1040	-.1300	-.1076	-.0389	-.0219	.297
.307	-.1035	-.1027	-.1250	-.1025	-.0338	-.0141	.307
.318	-.0830	-.0963	-.1174	-.0937	-.0274	-.0077	.318
.328	-.0714	-.0861	-.1136	-.0937	-.0250	-.0052	.328
.338	-.0598	-.0746	-.1047	-.0898	-.0173	-.0001	.338
.348	-.0496	-.0644	-.1021	-.0898	-.0122	.0076	.348
.353	-.0431	-.0595	-.1013	-.1005	-.0148	.0108	.353
.369	-.0405	-.0555	-.0974	-.1019	-.0174	.0108	.369
.379	-.0340	-.0502	-.0922	-.0928	-.0161	.0121	.379
.400	-.0235	-.0396	-.0845	-.0928	-.0201	.0068	.400
.441	-.0116	-.0290	-.0741	-.0901	-.0174	.0095	.441
.451	-.0130	-.0277	-.0702	-.0875	-.0161	.0082	.451
.482	-.0156	-.0277	-.0585	-.0824	-.0174	.0068	.482
.647	.0054	-.0157	-.0326	-.0473	.0128	.0357	.647
.729	-.0077	-.0197	-.0391	-.0512	.0049	.0252	.729
.812	-.0077	-.0210	-.0391	-.0577	-.0017	.0239	.812
.863	-.0025	-.0210	-.0391	-.0551	.0036	.0278	.863
.904	.1208	.0851	.0944	.0760	.1323	.1630	.904
.945	.0631	.0414	.0374	.0501	.1258	.1498	.945
.987	.0566	.0307	.0154	.0267	.1061	.1407	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(d) $M = 1.90$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6442						.024
.035	.2010						.035
.055	.2941						.055
.065	-.1201						.065
.076	-.0993						.076
.091	-.0773						.091
.101	-.0618						.101
.112	-.0527						.112
.122	-.0450						.122
.132	-.0372						.132
.153	-.0294						.153
.173	-.0255						.173
.184	-.0178						.184
.194	.0987						.194
.204	.0922						.204
.215	.0857						.215
.235	.0754						.235
.256	.0690						.256
.276	.0650						.276
.287	-.0165						.287
.297	-.0579						.297
.307	-.0527						.307
.318	-.0489						.318
.328	-.0450						.328
.338	-.0398						.338
.348	-.0346						.348
.353	-.0321						.353
.369	-.0294						.369
.379	-.0281						.379
.400	-.0254						.400
.441	-.0201						.441
.451	-.0187						.451
.482	-.0174						.482
.647	-.0027						.647
.729	-.0067						.729
.812	-.0107						.812
.863	-.0107						.863
.904	.0882						.904
.945	.0615						.945
.987	.0467						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(e) $M = 190; \alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6351	1.6298	1.6255	1.6356	1.6287	1.6259	.024
.035	.1009	.1236	.1937	.2588	.3201	.3262	.035
.055	.2089	.2241	.2787	.3335	.3794	.3820	.055
.065	-.1513	-.1432	-.1232	-.0995	-.0759	-.0730	.065
.076	-.1281	-.1200	-.1016	-.0792	-.0553	-.0509	.076
.091	-.1024	-.0955	-.0852	-.0640	-.0398	-.0354	.091
.101	-.0780	-.0800	-.0712	-.0526	-.0308	-.0250	.101
.112	-.0638	-.0658	-.0636	-.0501	-.0268	-.0224	.112
.122	-.0510	-.0543	-.0572	-.0488	-.0243	-.0198	.122
.132	-.0406	-.0439	-.0521	-.0450	-.0204	-.0160	.132
.153	-.0278	-.0311	-.0420	-.0399	-.0192	-.0134	.153
.173	-.0226	-.0272	-.0383	-.0375	-.0204	-.0134	.173
.184	-.0008	-.0092	-.0294	-.0310	-.0192	-.0120	.184
.194	.0931	.0887	.0847	.0891	.1099	.1188	.194
.204	.0815	.0811	.0809	.0879	.1099	.1176	.204
.215	.0739	.0733	.0772	.0816	.1073	.1137	.215
.235	.0584	.0592	.0683	.0765	.1008	.1085	.235
.256	.0468	.0488	.0594	.0714	.0983	.1046	.256
.276	.0429	.0476	.0569	.0714	.0983	.1072	.276
.287	-.0356	-.0323	-.0217	-.0109	.0119	.0191	.287
.297	-.0702	-.0698	-.0661	-.0577	-.0359	-.0302	.297
.307	-.0638	-.0633	-.0636	-.0539	-.0320	-.0289	.307
.318	-.0561	-.0581	-.0586	-.0488	-.0282	-.0224	.318
.328	-.0510	-.0530	-.0560	-.0475	-.0268	-.0211	.328
.338	-.0446	-.0465	-.0509	-.0450	-.0243	-.0186	.338
.348	-.0381	-.0401	-.0458	-.0425	-.0217	-.0134	.348
.353	-.0338	-.0391	-.0476	-.0397	-.0154	-.0095	.353
.369	-.0324	-.0378	-.0450	-.0410	-.0154	-.0082	.369
.379	-.0284	-.0324	-.0424	-.0370	-.0128	-.0055	.379
.400	-.0244	-.0271	-.0398	-.0370	-.0128	-.0055	.400
.441	-.0164	-.0192	-.0294	-.0292	-.0114	-.0042	.441
.451	-.0151	-.0192	-.0294	-.0292	-.0114	-.0055	.451
.482	-.0124	-.0165	-.0294	-.0292	-.0128	-.0055	.482
.647	-.0004	-.0071	-.0163	-.0161	.0019	.0119	.647
.729	-.0045	-.0085	-.0175	-.0174	.0005	.0092	.729
.812	-.0058	-.0098	-.0163	-.0200	-.0021	.0052	.812
.863	-.0070	-.0125	-.0163	-.0187	.0005	.0092	.863
.904	.0985	.0581	.0819	.0716	.0803	.0921	.904
.945	.0530	.0514	.0584	.0625	.0843	.0961	.945
.987	.0370	.0368	.0348	.0402	.0630	.0733	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(f) $M = 1.90$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6164	1.6056	1.5935	1.6183	1.6045	1.5967	.024
.035	.0224	.0446	.1708	.3005	.4466	.4688	.035
.055	.1466	.1618	.2493	.3437	.4697	.4869	.055
.065	-.1718	-.1716	-.1390	-.0977	-.0320	-.0209	.065
.076	-.1459	-.1498	-.1225	-.0762	-.0101	-.0015	.076
.091	-.1084	-.1189	-.1099	-.0711	.0003	.0101	.091
.101	-.0812	-.0983	-.1024	-.0685	.0054	.0178	.101
.112	-.0605	-.0816	-.1024	-.0685	.0054	.0192	.112
.122	-.0463	-.0687	-.1024	-.0711	.0041	.0178	.122
.132	-.0333	-.0558	-.1024	-.0711	.0041	.0166	.132
.153	-.0203	-.0404	-.0922	-.0762	.0003	.0152	.153
.173	-.0139	-.0339	-.0859	-.0888	-.0075	.0101	.173
.184	.0029	.0137	-.0733	-.0863	-.0049	.0127	.184
.194	.1000	.0627	.0456	.0215	.1241	.1497	.194
.204	.0806	.0562	.0431	.0304	.1254	.1497	.204
.215	.0664	.0472	.0393	.0342	.1228	.1471	.215
.235	.0508	.0343	.0292	.0443	.1176	.1419	.235
.256	.0392	.0266	.0279	.0456	.1189	.1406	.256
.276	.0340	.0215	.0241	.0456	.1267	.1458	.276
.287	-.0411	-.0532	-.0505	-.0305	.0351	.0501	.287
.297	-.0877	-.0751	-.0935	-.0786	-.0152	.0011	.297
.307	-.0773	-.0738	-.0897	-.0748	-.0114	.0023	.307
.318	-.0631	-.0687	-.0884	-.0723	-.0075	.0075	.318
.328	-.0540	-.0661	-.0871	-.0723	-.0075	.0101	.328
.338	-.0463	-.0610	-.0833	-.0723	-.0037	.0114	.338
.348	-.0398	-.0520	-.0783	-.0698	-.0011	.0152	.348
.353	-.0328	-.0474	-.0799	-.0721	-.0013	.0177	.353
.369	-.0301	-.0461	-.0799	-.0734	-.0040	.0177	.369
.379	-.0261	-.0422	-.0773	-.0734	-.0013	.0203	.379
.400	-.0221	-.0368	-.0721	-.0746	-.0040	.0163	.400
.441	-.0141	-.0301	-.0605	-.0746	-.0040	.0163	.441
.451	-.0141	-.0275	-.0579	-.0746	-.0067	.0122	.451
.482	-.0141	-.0275	-.0553	-.0773	-.0107	.0095	.482
.647	-.0020	-.0208	-.0269	-.0510	.0000	.0230	.647
.729	-.0087	-.0221	-.0269	-.0523	-.0013	.0177	.729
.812	-.0087	-.0208	-.0229	-.0523	-.0067	.0190	.812
.863	-.0074	-.0221	-.0217	-.0471	-.0013	.0217	.863
.904	.0609	.0593	.0728	.0306	.0802	.1038	.904
.945	.0783	.0352	.0379	.0424	.0936	.1253	.945
.987	.0381	.0193	.0197	.0148	.0856	.1105	.987

TABLE I.-- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(g) $M = 2.16$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6922						.024
.035	.2182						.035
.055	.2789						.055
.065	-.0824						.065
.076	-.0689						.076
.091	-.0568						.091
.101	-.0487						.101
.112	-.0433						.112
.122	-.0365						.122
.132	-.0311						.132
.153	-.0272						.153
.173	-.0231						.173
.184	-.0190						.184
.194	.0848						.194
.204	.0807						.204
.215	.0780						.215
.235	.0727						.235
.256	.0659						.256
.276	.0632						.276
.287	-.0015						.287
.297	-.0420						.297
.307	-.0406						.307
.318	-.0392						.318
.328	-.0365						.328
.338	-.0338						.338
.348	-.0311						.348
.353	-.0249						.353
.369	-.0235						.369
.379	-.0221						.379
.400	-.0194						.400
.441	-.0152						.441
.451	-.0166						.451
.482	-.0166						.482
.647	-.0026						.647
.729	-.0095						.729
.812	-.0068						.812
.863	-.0068						.863
.904	.0628						.904
.945	.0587						.945
.987	.0434						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(h) $M = 2.16$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6906		1.6800	1.6907	1.6851	1.6797	.024
.035	.1321		.2209	.2769	.3285	.3290	.035
.055	.2032		.2816	.3271	.3796	.3747	.055
.065	-.1118		-.0782	-.0595	-.0372	-.0357	.065
.076	-.0998		-.0677	-.0489	-.0265	-.0249	.076
.091	-.0770		-.0571	-.0423	-.0212	-.0209	.091
.101	-.0609		-.0479	-.0370	-.0144	-.0129	.101
.112	-.0515		-.0439	-.0331	-.0131	-.0115	.112
.122	-.0435		-.0426	-.0331	-.0104	-.0101	.122
.132	-.0354		-.0399	-.0305	-.0077	-.0074	.132
.153	-.0233		-.0321	-.0278	-.0077	-.0074	.153
.173	-.0194		-.0308	-.0292	-.0077	-.0061	.173
.184	-.0073		-.0268	-.0265	-.0050	-.0034	.184
.194	.0825		.0773	.0830	.1053	.1096	.194
.204	.0745		.0773	.0857	.1079	.1096	.204
.215	.0691		.0747	.0817	.1079	.1083	.215
.235	.0571		.0707	.0804	.1026	.1056	.235
.256	.0490		.0641	.0764	.0999	.1015	.256
.276	.0450		.0615	.0751	.0999	.1015	.276
.287	-.0180		-.0057	.0065	.0300	.0302	.287
.297	-.0488		-.0479	-.0397	-.0185	-.0169	.297
.307	-.0475		-.0465	-.0397	-.0185	-.0169	.307
.318	-.0435		-.0426	-.0358	-.0158	-.0142	.318
.328	-.0408		-.0413	-.0331	-.0144	-.0129	.328
.338	-.0368		-.0399	-.0318	-.0104	-.0115	.338
.348	-.0328		-.0386	-.0292	-.0090	-.0088	.348
.353	-.0325		-.0373	-.0231	-.0040	-.0096	.353
.369	-.0311		-.0373	-.0244	-.0053	-.0096	.369
.379	-.0270		-.0332	-.0244	-.0040	-.0069	.379
.400	-.0242		-.0319	-.0244	-.0040	-.0082	.400
.441	-.0200		-.0277	-.0231	-.0040	-.0069	.441
.451	-.0186		-.0291	-.0231	-.0067	-.0069	.451
.482	-.0172		-.0264	-.0231	-.0067	-.0138	.482
.647	-.0089		-.0155	-.0108	.0002	.0001	.647
.729	-.0145		-.0155	-.0149	-.0053	-.0096	.729
.812	-.0145		-.0169	-.0149	-.0026	-.0027	.812
.863	-.0145		-.0155	-.0149	-.0012	-.0027	.863
.904	.0620		.0527	.0488	.0571	.0558	.904
.945	.0397		.0527	.0637	.0793	.0823	.945
.987	.0217		.0310	.0407	.0667	.0670	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(i) $M = 2.16$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6722		1.6465	1.6780	1.6637	1.6541	.024
.035	.0579		.1919	.3100	.4408	.4544	.035
.055	.1361		.2498	.3510	.4649	.4772	.055
.065	-.1389		-.0927	-.0524	.0022	.0082	.065
.076	-.1228		-.0875	-.0457	.0117	.0203	.076
.091	-.0917		-.0796	-.0431	.0156	.0230	.091
.101	-.0689		-.0770	-.0417	.0170	.0283	.101
.112	-.0540		-.0783	-.0444	.0183	.0283	.112
.122	-.0419		-.0796	-.0457	.0183	.0283	.122
.132	-.0324		-.0822	-.0457	.0170	.0270	.132
.153	-.0203		-.0822	-.0524	.0156	.0257	.153
.173	-.0176		-.0849	-.0629	.0076	.0203	.173
.184	-.0068		-.0822	-.0642	.0076	.0217	.184
.194	.0822		.0126	.0244	.1283	.1453	.194
.204	.0688		.0193	.0297	.1283	.1439	.204
.215	.0593		.0232	.0297	.1270	.1453	.215
.235	.0445		.0245	.0376	.1243	.1399	.235
.256	.0336		.0232	.0429	.1216	.1359	.256
.276	.0310		.0219	.0482	.1229	.1386	.276
.287	-.0284		-.0361	-.0140	.0479	.0593	.287
.297	-.0689		-.0743	-.0563	-.0031	.0082	.297
.307	-.0580		-.0743	-.0550	-.0018	.0095	.307
.318	-.0553		-.0730	-.0524	.0009	.0122	.318
.328	-.0500		-.0717	-.0524	.0022	.0136	.328
.338	-.0446		-.0743	-.0510	.0049	.0163	.338
.348	-.0405		-.0743	-.0510	.0076	.0190	.348
.353	-.0387		-.0774	-.0588	.0124	.0166	.353
.369	-.0360		-.0746	-.0602	.0082	.0166	.369
.379	-.0332		-.0746	-.0602	.0096	.0180	.379
.400	-.0303		-.0733	-.0629	.0096	.0152	.400
.441	-.0275		-.0746	-.0698	.0055	.0180	.441
.451	-.0275		-.0746	-.0726	.0027	.0125	.451
.482	-.0261		-.0664	-.0726	-.0001	.0069	.482
.647	-.0234		-.0365	-.0520	.0027	.0166	.647
.729	-.0303		-.0392	-.0575	.0013	.0111	.729
.812	-.0289		-.0365	-.0561	-.0001	.0139	.812
.863	-.0234		-.0351	-.0561	-.0001	.0152	.863
.904	.0355		.0384	.0031	.0608	.0762	.904
.945	.0621		.0234	.0333	.0955	.1123	.945
.987	.0117		-.0011	.0126	.0858	.0970	.987

TABLE I.-- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(j) $M = 2.29$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6736						.024
.035	.2151						.035
.045	.2725						.045
.055	.2661						.055
.065	-.0662						.065
.076	-.0598						.076
.091	-.0502						.091
.101	-.0423						.101
.112	-.0343						.112
.122	-.0327						.122
.132	-.0279						.132
.153	-.0215						.153
.173	-.0183						.173
.184	-.0119						.184
.194	.0809						.194
.204	.0776						.204
.215	.0744						.215
.235	.0680						.235
.256	.0648						.256
.276	.0632						.276
.287	.0056						.287
.297	-.0441						.297
.307	-.0408						.307
.318	-.0424						.318
.328	-.0391						.328
.338	-.0376						.338
.348	-.0341						.348
.353	-.0326						.353
.369	-.0292						.369
.379	-.0276						.379
.400	-.0259						.400
.441	-.0209						.441
.451	-.0209						.451
.482	-.0177						.482
.647	-.0094						.647
.729	-.0127						.729
.812	-.0127						.812
.863	-.0110						.863
.904	.0518						.904
.945	.0535						.945
.987	.0535						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(k) $M = 2.29$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6699	1.6647	1.6566	1.6665	1.6784	1.6728	.024
.035	.1349	.1469	.1771	.2728	.3143	.3171	.035
.045	.1892	.1996	.2281	.3255	.3606	.3617	.045
.055	.1861	.1963	.2250	.3144	.3446	.3522	.055
.065	-.0966	-.0938	-.0874	-.0469	-.0317	-.0296	.065
.076	-.0904	-.0891	-.0827	-.0454	-.0301	-.0264	.076
.091	-.0712	-.0731	-.0715	-.0407	-.0253	-.0217	.091
.101	-.0599	-.0620	-.0620	-.0358	-.0205	-.0153	.101
.112	-.0504	-.0540	-.0556	-.0325	-.0188	-.0136	.112
.122	-.0424	-.0460	-.0524	-.0310	-.0173	-.0136	.122
.132	-.0343	-.0396	-.0477	-.0294	-.0157	-.0120	.132
.153	-.0248	-.0301	-.0397	-.0278	-.0157	-.0104	.153
.173	-.0200	-.0237	-.0365	-.0278	-.0157	-.0104	.173
.184	-.0089	-.0141	-.0285	-.0261	-.0141	-.0072	.184
.194	.0710	.0641	.0592	.0665	.0943	.0982	.194
.204	.0662	.0736	.0559	.0681	.1294	.0982	.204
.215	.0598	.0561	.0528	.0681	.0943	.0982	.215
.235	.0503	.0464	.0464	.0665	.0911	.0934	.235
.256	.0423	.0401	.0400	.0634	.0864	.0885	.256
.276	.0390	.0369	.0369	.0617	.0879	.0885	.276
.287	-.0153	-.0173	-.0158	.0042	.0242	.0247	.287
.297	-.0515	-.0480	-.0539	-.0404	-.0311	-.0255	.297
.307	-.0515	-.0480	-.0539	-.0421	-.0311	-.0255	.307
.318	-.0482	-.0480	-.0506	-.0388	-.0311	-.0238	.318
.328	-.0449	-.0447	-.0490	-.0388	-.0294	-.0222	.328
.338	-.0415	-.0430	-.0458	-.0371	-.0277	-.0205	.338
.348	-.0366	-.0381	-.0424	-.0339	-.0245	-.0172	.348
.353	-.0366	-.0364	-.0424	-.0339	-.0245	-.0172	.353
.369	-.0333	-.0364	-.0424	-.0339	-.0229	-.0155	.369
.379	-.0317	-.0315	-.0391	-.0322	-.0212	-.0155	.379
.400	-.0283	-.0298	-.0358	-.0322	-.0212	-.0140	.400
.441	-.0218	-.0233	-.0293	-.0306	-.0212	-.0123	.441
.451	-.0201	-.0233	-.0276	-.0306	-.0212	-.0123	.451
.482	-.0185	-.0199	-.0260	-.0306	-.0212	-.0123	.482
.647	-.0086	-.0133	-.0145	-.0191	-.0113	-.0040	.647
.729	-.0119	-.0149	-.0145	-.0224	-.0130	-.0073	.729
.812	-.0119	-.0149	-.0145	-.0207	-.0130	-.0090	.812
.863	-.0136	-.0149	-.0145	-.0191	-.0130	-.0090	.863
.904	.0491	.0412	.0463	.0369	.0416	.0486	.904
.945	.0474	.0330	.0365	.0566	.0680	.0799	.945
.987	.0376	.0330	.0315	.0418	.0648	.0733	.987

TABLE I.-- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued.

(1) $M = 2.29$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6661	1.6605	1.6461	1.6614	1.6591	1.6519	.024
.035	.0708	.0850	.1306	.3338	.4087	.4396	.035
.045	.1348	.1409	.1849	.3735	.4453	.4716	.045
.055	.1091	.1409	.1802	.3576	.4295	.4620	.055
.065	-.1208	-.1208	-.1125	-.0274	.0061	.0166	.065
.076	-.1095	-.1144	-.1109	-.0274	.0061	.0213	.076
.091	-.0825	-.0936	-.1045	-.0257	.0061	.0213	.091
.101	-.0633	-.0810	-.0997	-.0257	.0093	.0246	.101
.112	-.0489	-.0681	-.0981	-.0274	.0093	.0246	.112
.122	-.0393	-.0586	-.0965	-.0290	.0077	.0246	.122
.132	-.0314	-.0490	-.0932	-.0306	.0077	.0246	.132
.153	-.0201	-.0378	-.0821	-.0353	.0061	.0230	.153
.173	-.0154	-.0347	-.0725	-.0449	-.0003	.0182	.173
.184	-.0058	-.0139	-.0565	-.0465	-.0003	.0197	.184
.194	.0804	.0404	.0218	.0395	.1048	.1363	.194
.204	.0677	.0420	.0203	.0426	.1541	.1379	.204
.215	.0580	.0307	.0187	.0410	.1079	.1363	.215
.235	.0437	.0245	.0123	.0410	.1048	.1331	.235
.256	.0341	.0180	.0059	.0410	.1032	.1315	.256
.276	.0310	.0132	.0026	.0490	.1032	.1331	.276
.287	-.0201	-.0347	-.0453	-.0051	.0379	.0613	.287
.297	-.0648	-.0596	-.0862	-.0481	-.0084	.0044	.297
.307	-.0681	-.0629	-.0845	-.0465	-.0051	.0077	.307
.318	-.0582	-.0613	-.0795	-.0465	-.0034	.0094	.318
.328	-.0516	-.0596	-.0762	-.0448	-.0018	.0110	.328
.338	-.0467	-.0579	-.0747	-.0448	-.0018	.0110	.338
.348	-.0417	-.0497	-.0713	-.0432	.0014	.0127	.348
.353	-.0401	-.0497	-.0713	-.0448	-.0001	.0110	.353
.369	-.0367	-.0449	-.0697	-.0448	-.0018	.0110	.369
.379	-.0335	-.0432	-.0663	-.0448	-.0001	.0110	.379
.400	-.0302	-.0415	-.0615	-.0465	-.0018	.0110	.400
.441	-.0220	-.0382	-.0515	-.0513	-.0034	.0110	.441
.451	-.0220	-.0365	-.0483	-.0513	-.0051	.0110	.451
.482	-.0203	-.0349	-.0433	-.0530	-.0084	.0110	.482
.647	-.0088	-.0299	-.0301	-.0465	-.0034	.0159	.647
.729	-.0120	-.0299	-.0285	-.0432	-.0051	.0110	.729
.812	-.0137	-.0299	-.0251	-.0415	-.0051	.0110	.812
.863	-.0153	-.0299	-.0251	-.0400	-.0051	.0110	.863
.904	.0308	.0327	.0326	.0141	.0490	.0703	.904
.945	.0852	.0129	.0194	.0435	.0851	.1115	.945
.987	.0308	.0080	.0161	.0321	.0851	.1099	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(m) $M = 2.96$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7259						.024
.035	.2276						.035
.045	.2352						.045
.055	.2164						.055
.065	-.0253						.065
.076	-.0290						.076
.091	-.0290						.091
.101	-.0253						.101
.112	-.0253						.112
.122	-.0234						.122
.132	-.0234						.132
.153	-.0214						.153
.173	-.0196						.173
.184	-.0177						.184
.194	.0502						.194
.204	.0502						.204
.215	.0502						.215
.235	.0502						.235
.256	.0502						.256
.276	.0502						.276
.287	.0143						.287
.297	-.0240						.297
.307	-.0260						.307
.318	-.0280						.318
.328	-.0280						.328
.338	-.0280						.338
.348	-.0260						.348
.353	-.0240						.353
.369	-.0240						.369
.379	-.0240						.379
.400	-.0240						.400
.441	-.0240						.441
.451	-.0222						.451
.482	-.0143						.482
.647	-.0103						.647
.729	-.0123						.729
.812	-.0085						.812
.863	-.0085						.863
.904	-.0248						.904
.945	.0405						.945
.987	.0405						.987

TABLE I.-- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(n) $M = 2.96$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7209	1.6831	1.7047	1.7148	1.7149	1.6724	.024
.035	.1547	.1614	.1873	.2668	.2996	.3107	.035
.045	.1623	.1728	.1967	.2782	.3090	.3182	.045
.055	.1433	.1538	.1836	.2592	.2977	.3145	.055
.065	-.0571	-.0537	-.0406	-.0122	.0082	.0088	.065
.076	-.0571	-.0537	-.0444	-.0159	.0006	.0031	.076
.091	-.0534	-.0498	-.0424	-.0198	-.0032	-.0045	.091
.101	-.0477	-.0443	-.0406	-.0198	-.0032	-.0045	.101
.112	-.0439	-.0423	-.0406	-.0198	-.0032	-.0063	.112
.122	-.0420	-.0386	-.0387	-.0216	-.0032	-.0063	.122
.132	-.0382	-.0347	-.0369	-.0198	-.0032	-.0063	.132
.153	-.0325	-.0310	-.0330	-.0216	-.0032	-.0045	.153
.173	-.0269	-.0273	-.0312	-.0216	-.0032	-.0063	.173
.184	-.0212	-.0216	-.0275	-.0216	-.0032	-.0045	.184
.194	.0356	.0387	.0347	.0443	.0683	.0729	.194
.204	.0356	.0444	.0347	.0482	.0927	.0766	.204
.215	.0317	.0369	.0347	.0500	.0739	.0766	.215
.235	.0280	.0350	.0347	.0519	.0720	.0766	.235
.256	.0260	.0332	.0347	.0537	.0739	.0766	.256
.276	.0260	.0332	.0347	.0557	.0739	.0786	.276
.287	-.0099	-.0028	.0008	.0179	.0363	.0351	.287
.297	-.0322	-.0301	-.0268	-.0188	-.0126	-.0126	.297
.307	-.0342	-.0339	-.0307	-.0227	-.0147	-.0145	.307
.318	-.0322	-.0339	-.0325	-.0247	-.0147	-.0145	.318
.328	-.0322	-.0339	-.0307	-.0247	-.0147	-.0145	.328
.338	-.0322	-.0339	-.0307	-.0227	-.0147	-.0145	.338
.348	-.0303	-.0339	-.0287	-.0227	-.0147	-.0126	.348
.353	-.0303	-.0339	-.0287	-.0227	-.0147	-.0126	.353
.369	-.0283	-.0339	-.0268	-.0227	-.0147	-.0106	.369
.379	-.0263	-.0242	-.0268	-.0227	-.0126	-.0106	.379
.400	-.0263	-.0242	-.0268	-.0227	-.0108	-.0106	.400
.441	-.0225	-.0222	-.0228	-.0208	-.0108	-.0106	.441
.451	-.0205	-.0222	-.0228	-.0227	-.0108	-.0106	.451
.482	-.0205	-.0204	-.0210	-.0227	-.0126	-.0106	.482
.647	-.0166	-.0145	-.0113	-.0168	-.0068	-.0068	.647
.729	-.0166	-.0145	-.0113	-.0168	-.0088	-.0086	.729
.812	-.0166	-.0145	-.0113	-.0188	-.0108	-.0086	.812
.863	-.0166	-.0145	-.0113	-.0168	-.0088	-.0086	.863
.904	.0166	.0188	.0278	.0202	.0264	.0285	.904
.945	.0283	.0227	.0278	.0474	.0595	.0657	.945
.987	.0243	.0247	.0278	.0415	.0575	.0598	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(o) $M = 2.96$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.6941	1.6848	1.6478	1.6863	1.6797	1.6859	.024
.035	.1046	.1177	.1516	.3141	.3779	.4075	.035
.045	.1177	.1345	.1610	.3216	.3855	.4151	.045
.055	.0989	.1121	.1516	.3179	.3892	.4227	.055
.065	-.0687	-.0602	-.0575	.0117	.0424	.0543	.065
.076	-.0687	-.0620	-.0594	.0023	.0312	.0429	.076
.091	-.0593	-.0583	-.0612	-.0089	.0216	.0316	.091
.101	-.0481	-.0526	-.0612	-.0128	.0197	.0316	.101
.112	-.0424	-.0470	-.0612	-.0128	.0179	.0316	.112
.122	-.0348	-.0395	-.0631	-.0147	.0179	.0316	.122
.132	-.0293	-.0358	-.0631	-.0147	.0179	.0316	.132
.153	-.0217	-.0282	-.0631	-.0184	.0160	.0296	.153
.173	-.0179	-.0264	-.0594	-.0259	.0122	.0278	.173
.184	-.0142	-.0190	-.0518	-.0278	.0103	.0259	.184
.194	.0405	.0298	.0009	.0379	.0876	.1128	.194
.204	.0405	.0353	.0046	.0437	.1254	.1203	.204
.215	.0348	.0298	.0066	.0437	.0952	.1185	.215
.235	.0273	.0259	.0066	.0455	.0933	.1166	.235
.256	.0236	.0241	.0046	.0455	.0933	.1166	.256
.276	.0236	.0241	.0028	.0474	.0952	.1185	.276
.287	-.0103	-.0077	-.0273	.0117	.0518	.0694	.287
.297	-.0348	-.0325	-.0520	-.0307	.0011	.0133	.297
.307	-.0368	-.0384	-.0558	-.0325	-.0028	.0133	.307
.318	-.0348	-.0384	-.0558	-.0325	-.0009	.0153	.318
.328	-.0328	-.0384	-.0540	-.0325	-.0009	.0153	.328
.338	-.0328	-.0384	-.0520	-.0325	-.0009	.0153	.338
.348	-.0310	-.0344	-.0481	-.0325	.0011	.0153	.348
.353	-.0310	-.0325	-.0481	-.0346	-.0009	.0153	.353
.369	-.0290	-.0325	-.0461	-.0346	-.0028	.0153	.369
.379	-.0271	-.0305	-.0461	-.0346	-.0028	.0133	.379
.400	-.0251	-.0287	-.0423	-.0346	-.0028	.0133	.400
.441	-.0213	-.0267	-.0384	-.0384	-.0028	.0113	.441
.451	-.0213	-.0267	-.0364	-.0384	-.0028	.0094	.451
.482	-.0193	-.0267	-.0344	-.0384	-.0068	.0074	.482
.647	-.0134	-.0267	-.0287	-.0443	-.0068	.0113	.647
.729	-.0134	-.0267	-.0267	-.0463	-.0106	.0074	.729
.812	-.0134	-.0247	-.0267	-.0423	-.0145	.0054	.812
.863	-.0154	-.0228	-.0267	-.0404	-.0126	.0054	.863
.904	.0157	.0103	.0065	-.0111	.0245	.0446	.904
.945	.0604	.0065	.0065	.0239	.0676	.0975	.945
.987	.0390	.0026	.0065	.0239	.0676	.0896	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(p) $M = 3.96$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7563						.024
.035	.2361						.035
.045	.2138						.045
.055	.1946						.055
.065	.0052						.065
.076	-.0109						.076
.091	-.0109						.091
.101	-.0109						.101
.112	-.0140						.112
.122	-.0174						.122
.132	-.0174						.132
.153	-.0174						.153
.173	-.0205						.173
.184	-.0238						.184
.194	.0213						.194
.204	.0213						.204
.215	.0213						.215
.235	.0244						.235
.256	.0277						.256
.276	.0308						.276
.287	.0085						.287
.297	-.0048						.297
.307	-.0147						.307
.318	-.0147						.318
.328	-.0147						.328
.338	-.0147						.338
.348	-.0180						.348
.353	-.0180						.353
.369	-.0180						.369
.379	-.0180						.379
.400	-.0147						.400
.441	-.0147						.441
.451	-.0147						.451
.482	-.0147						.482
.647	-.0147						.647
.729	-.0147						.729
.812	-.0147						.812
.863	-.0147						.863
.904	.0120						.904
.945	.0252						.945
.987	.0252						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(q) $M = 3.96$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7544	1.7113	1.7199	1.6818	1.7202	1.7472	.024
.035	.1715	.1896	.2113	.2719	.2959	.3101	.035
.045	.1554	.1746	.1913	.2541	.2782	.2875	.045
.055	.1362	.1495	.1735	.2339	.2607	.2747	.055
.065	-.0175	-.0084	-.0004	.0173	.0269	.0372	.065
.076	-.0206	-.0158	-.0105	.0072	.0171	.0277	.076
.091	-.0239	-.0185	-.0155	-.0004	.0043	.0149	.091
.101	-.0206	-.0185	-.0179	-.0054	-.0006	.0085	.101
.112	-.0206	-.0185	-.0206	-.0078	-.0031	.0052	.112
.122	-.0206	-.0185	-.0231	-.0078	-.0056	.0021	.122
.132	-.0206	-.0185	-.0231	-.0105	-.0082	-.0012	.132
.153	-.0206	-.0185	-.0231	-.0130	-.0082	-.0012	.153
.173	-.0175	-.0109	-.0206	-.0179	-.0132	-.0012	.173
.184	-.0142	-.0084	-.0155	-.0179	-.0132	-.0012	.184
.194	.0016	.0016	.0097	.0247	.0370	.0502	.194
.204	.0049	.0066	.0122	.0274	.0547	.0533	.204
.215	.0082	.0090	.0122	.0299	.0471	.0597	.215
.235	.0113	.0142	.0148	.0348	.0496	.0630	.235
.256	.0113	.0167	.0148	.0375	.0522	.0630	.256
.276	.0113	.0191	.0148	.0375	.0522	.0597	.276
.287	-.0047	.0041	.0021	.0173	.0269	.0372	.287
.297	-.0085	-.0033	-.0157	-.0027	.0049	.0074	.297
.307	-.0150	-.0084	-.0208	-.0078	-.0004	.0008	.307
.318	-.0150	-.0136	-.0235	-.0130	-.0029	-.0023	.318
.328	-.0150	-.0136	-.0235	-.0130	-.0056	-.0023	.328
.338	-.0150	-.0136	-.0260	-.0130	-.0029	-.0056	.338
.348	-.0150	-.0084	-.0235	-.0130	-.0029	-.0023	.348
.353	-.0150	-.0136	-.0260	-.0130	-.0029	-.0023	.353
.369	-.0150	-.0084	-.0260	-.0130	-.0029	-.0023	.369
.379	-.0150	-.0136	-.0260	-.0130	-.0029	-.0023	.379
.400	-.0150	-.0084	-.0235	-.0130	-.0029	-.0023	.400
.441	-.0150	-.0084	-.0208	-.0130	-.0029	-.0023	.441
.451	-.0150	-.0060	-.0208	-.0130	-.0029	-.0023	.451
.482	-.0150	-.0084	-.0208	-.0130	-.0029	-.0023	.482
.647	-.0085	-.0008	-.0157	-.0130	-.0029	-.0023	.647
.729	-.0085	-.0008	-.0130	-.0130	-.0029	-.0023	.729
.812	-.0085	-.0008	-.0130	-.0130	-.0029	-.0023	.812
.863	-.0085	-.0008	-.0130	-.0130	-.0056	-.0023	.863
.904	.0113	.0148	.0078	.0078	.0152	.0140	.904
.945	.0179	.0226	.0130	.0338	.0463	.0469	.945
.987	.0212	.0251	.0130	.0311	.0438	.0436	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(r) M = 3.96; $\alpha = 8^\circ$

Model station, x_1/l	C _p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7342	1.6997	1.6593	1.6773	1.7177	1.7185	.024
.035	.1230	.1385	.1805	.3172	.3714	.3988	.035
.045	.1134	.1259	.1579	.3019	.3564	.3891	.045
.055	.0911	.1033	.1379	.2844	.3539	.4019	.055
.065	-.0272	-.0229	-.0132	.0425	.0598	.0818	.065
.076	-.0303	-.0330	-.0206	.0274	.0420	.0563	.076
.091	-.0303	-.0330	-.0231	.0097	.0245	.0402	.091
.101	-.0272	-.0330	-.0258	.0047	.0169	.0338	.101
.112	-.0239	-.0330	-.0282	-.0004	.0169	.0338	.112
.122	-.0239	-.0330	-.0332	-.0004	.0144	.0338	.122
.132	-.0239	-.0330	-.0332	-.0004	.0144	.0338	.132
.153	-.0208	-.0330	-.0332	-.0029	.0144	.0338	.153
.173	-.0175	-.0357	-.0332	-.0080	.0120	.0305	.173
.184	-.0080	-.0330	-.0258	-.0105	.0120	.0305	.184
.194	.0175	-.0103	-.0157	.0324	.0699	.0979	.194
.204	.0175	-.0103	-.0206	.0400	.0975	.1043	.204
.215	.0111	-.0054	-.0181	.0425	.0824	.1074	.215
.235	.0016	-.0027	-.0206	.0425	.0798	.1074	.235
.256	.0016	-.0027	-.0181	.0425	.0798	.1074	.256
.276	.0016	-.0002	-.0206	.0425	.0824	.1138	.276
.287	-.0111	-.0155	-.0231	.0223	.0546	.0785	.287
.297	-.0251	-.0157	-.0286	-.0025	.0258	.0311	.297
.307	-.0284	-.0183	-.0392	-.0076	.0258	.0278	.307
.318	-.0317	-.0262	-.0416	-.0103	.0258	.0278	.318
.328	-.0317	-.0262	-.0416	-.0103	.0258	.0278	.328
.338	-.0284	-.0262	-.0392	-.0128	.0258	.0278	.338
.348	-.0284	-.0235	-.0365	-.0128	.0258	.0212	.348
.353	-.0284	-.0262	-.0365	-.0128	.0258	.0278	.353
.369	-.0284	-.0235	-.0365	-.0128	.0258	.0278	.369
.379	-.0284	-.0262	-.0365	-.0128	.0233	.0245	.379
.400	-.0284	-.0235	-.0338	-.0128	.0233	.0245	.400
.441	-.0284	-.0262	-.0286	-.0155	.0206	.0245	.441
.451	-.0251	-.0262	-.0262	-.0155	.0206	.0245	.451
.482	-.0251	-.0262	-.0262	-.0181	.0155	.0212	.482
.647	-.0251	-.0262	-.0235	-.0206	.0103	.0212	.647
.729	-.0216	-.0235	-.0235	-.0233	.0103	.0179	.729
.812	-.0251	-.0208	-.0235	-.0260	.0049	.0179	.812
.863	-.0251	-.0183	-.0235	-.0338	.0049	.0179	.863
.904	-.0085	.0000	-.0078	-.0128	.0309	.0410	.904
.945	.0212	.0052	.0025	.0132	.0674	.0839	.945
.987	.0179	.0000	-.0027	.0159	.0674	.0806	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(s) $M = 4.65$; $\alpha = 0^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.8107						.024
.035	.2440						.035
.045	.2156						.045
.055	.1993						.055
.065	.0237						.065
.076	.0074						.076
.091	-.0008						.091
.101	-.0047						.101
.112	-.0047						.112
.122	-.0171						.122
.132	-.0171						.132
.153	-.0171						.153
.173	-.0171						.173
.184	-.0129						.184
.194	.0116						.194
.204	.0116						.204
.215	.0116						.215
.235	.0155						.235
.256	.0155						.256
.276	.0237						.276
.287	.0116						.287
.297	-.0029						.297
.307	-.0071						.307
.318	-.0113						.318
.328	-.0113						.328
.338	-.0113						.338
.348	-.0113						.348
.353	-.0113						.353
.369	-.0113						.369
.379	-.0113						.379
.400	-.0113						.400
.441	-.0113						.441
.451	-.0113						.451
.482	-.0113						.482
.647	-.0113						.647
.729	-.0113						.729
.812	-.0113						.812
.863	-.0113						.863
.904	-.0029						.904
.945	.0097						.945
.987	.0140						.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE
MODEL OF A THREE-STAGE SCOUT VEHICLE - Continued

(t) $M = 4.65$; $\alpha = 4^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.8049	1.8010	1.7894	1.8010	1.7351	1.7946	.024
.035	.1906	.1924	.2203	.2930	.3103	.3162	.035
.045	.1579	.1664	.1945	.2672	.2845	.2876	.045
.055	.1377	.1440	.1690	.2448	.2685	.2795	.055
.065	.0032	.0050	.0111	.0461	.0466	.0519	.065
.076	-.0089	-.0111	-.0016	.0268	.0305	.0357	.076
.091	-.0089	-.0111	-.0016	.0174	.0176	.0233	.091
.101	-.0089	-.0145	-.0016	.0076	.0145	.0152	.101
.112	-.0089	-.0145	-.0050	.0045	.0079	.0152	.112
.122	-.0089	-.0145	-.0050	.0045	.0047	.0071	.122
.132	-.0132	-.0176	-.0050	.0045	.0016	.0071	.132
.153	-.0089	-.0145	-.0050	.0013	.0016	.0071	.153
.173	-.0089	-.0111	-.0016	.0013	-.0018	.0071	.173
.184	-.0089	-.0111	-.0016	.0045	.0047	.0071	.184
.194	.0113	.0050	.0047	.0332	.0400	.0477	.194
.204	.0032	-.0016	-.0016	.0332	.0466	.0477	.204
.215	-.0050	-.0016	.0016	.0429	.0466	.0558	.215
.235	.0032	-.0016	.0047	.0461	.0466	.0600	.235
.256	.0032	-.0016	.0111	.0461	.0561	.0640	.256
.276	.0032	.0018	.0111	.0492	.0561	.0640	.276
.287	-.0089	-.0079	-.0016	.0300	.0337	.0438	.287
.297	.0013	-.0061	.0003	.0134	.0203	.0178	.297
.307	-.0071	-.0095	.0003	.0003	.0105	.0094	.307
.318	-.0113	-.0129	.0003	.0003	.0071	.0052	.318
.328	-.0113	-.0129	.0003	.0003	.0037	.0052	.328
.338	-.0113	-.0161	-.0063	.0003	.0037	.0010	.338
.348	-.0071	-.0129	.0003	.0003	.0037	.0094	.348
.353	-.0071	-.0161	-.0063	.0003	.0037	.0052	.353
.369	-.0071	-.0129	-.0063	.0003	.0037	.0094	.369
.379	-.0113	-.0161	-.0063	.0003	.0037	.0052	.379
.400	-.0071	-.0161	-.0063	.0003	.0037	.0052	.400
.441	-.0071	-.0161	-.0063	.0003	.0037	.0052	.441
.451	-.0071	-.0129	-.0063	.0003	.0071	.0094	.451
.482	-.0071	-.0129	-.0063	.0003	.0037	.0052	.482
.647	-.0029	-.0095	.0003	.0003	.0037	.0052	.647
.729	-.0071	-.0095	.0003	.0003	.0005	.0052	.729
.812	-.0071	-.0095	.0003	.0003	-.0063	.0010	.812
.863	-.0071	-.0095	.0003	.0003	-.0063	.0010	.863
.904	.0055	.0005	.0003	.0003	.0137	.0178	.904
.945	.0097	.0140	.0200	.0300	.0437	.0472	.945
.987	.0140	.0140	.0200	.0334	.0437	.0472	.987

TABLE I.- PRESSURE COEFFICIENTS MEASURED ON A 1/10-SCALE

MODEL OF A THREE-STAGE SCOUT VEHICLE - Concluded

(u) $M = 4.65$; $\alpha = 8^\circ$

Model station, x_1/l	C_p at -						Model station, x_1/l
	$\theta = 0^\circ$	$\theta = 30^\circ$	$\theta = 60^\circ$	$\theta = 120^\circ$	$\theta = 150^\circ$	$\theta = 180^\circ$	
.024	1.7576	1.7409	1.7380	1.7409	1.7552	1.7449	.024
.035	.1290	.1500	.1843	.3230	.3822	.3943	.035
.045	.1088	.1274	.1587	.3003	.3696	.3780	.045
.055	.0844	.1016	.1392	.2874	.3696	.3904	.055
.065	-.0131	-.0016	.0013	.0561	.0908	.0929	.065
.076	-.0254	-.0176	-.0018	.0369	.0587	.0642	.076
.091	-.0254	-.0176	-.0082	.0174	.0429	.0479	.091
.101	-.0212	-.0208	-.0147	.0111	.0332	.0397	.101
.112	-.0212	-.0208	-.0179	.0079	.0332	.0397	.112
.122	-.0212	-.0208	-.0211	.0047	.0332	.0397	.122
.132	-.0212	-.0208	-.0242	.0047	.0300	.0397	.132
.153	-.0173	-.0208	-.0179	.0013	.0300	.0397	.153
.173	-.0173	-.0208	-.0147	-.0050	.0300	.0397	.173
.184	-.0173	-.0208	-.0147	-.0050	.0268	.0358	.184
.194	.0071	-.0016	.0013	.0400	.0845	.0929	.194
.204	-.0010	-.0113	-.0082	.0432	.1100	.1011	.204
.215	.0031	-.0113	-.0082	.0497	.1006	.1050	.215
.235	-.0092	-.0047	-.0082	.0497	.0971	.1050	.235
.256	-.0092	-.0047	.0082	.0497	.1006	.1050	.256
.276	-.0092	-.0047	-.0082	.0529	.1037	.1132	.276
.287	-.0173	-.0145	-.0179	.0337	.0779	.0848	.287
.297	-.0073	-.0095	-.0163	.0166	.0337	.0479	.297
.307	-.0157	-.0163	-.0229	.0134	.0271	.0353	.307
.318	-.0157	-.0261	-.0263	.0000	.0271	.0353	.318
.328	-.0157	-.0329	-.0263	.0000	.0271	.0353	.328
.338	-.0157	-.0329	-.0263	.0000	.0271	.0353	.338
.348	-.0115	-.0261	-.0197	.0000	.0271	.0353	.348
.353	-.0157	-.0329	-.0229	.0000	.0271	.0353	.353
.369	-.0115	-.0329	-.0229	.0000	.0271	.0353	.369
.379	-.0157	-.0329	-.0229	.0000	.0271	.0353	.379
.400	-.0157	-.0329	-.0197	.0000	.0271	.0353	.400
.441	-.0157	-.0329	-.0229	.0000	.0271	.0353	.441
.451	-.0157	-.0163	-.0163	.0000	.0271	.0353	.451
.482	-.0157	-.0295	-.0197	.0000	.0271	.0311	.482
.647	-.0157	-.0295	-.0197	.0000	.0271	.0311	.647
.729	-.0157	-.0295	-.0197	.0000	.0237	.0311	.729
.812	-.0157	-.0295	-.0197	.0000	.0205	.0268	.812
.863	-.0157	-.0295	-.0197	.0000	.0205	.0268	.863
.904	-.0031	-.0095	-.0097	.0000	.0337	.0437	.904
.945	.0178	-.0095	.0003	.0332	.0771	.0858	.945
.987	.0178	-.0095	.0003	.0397	.0803	.0858	.987

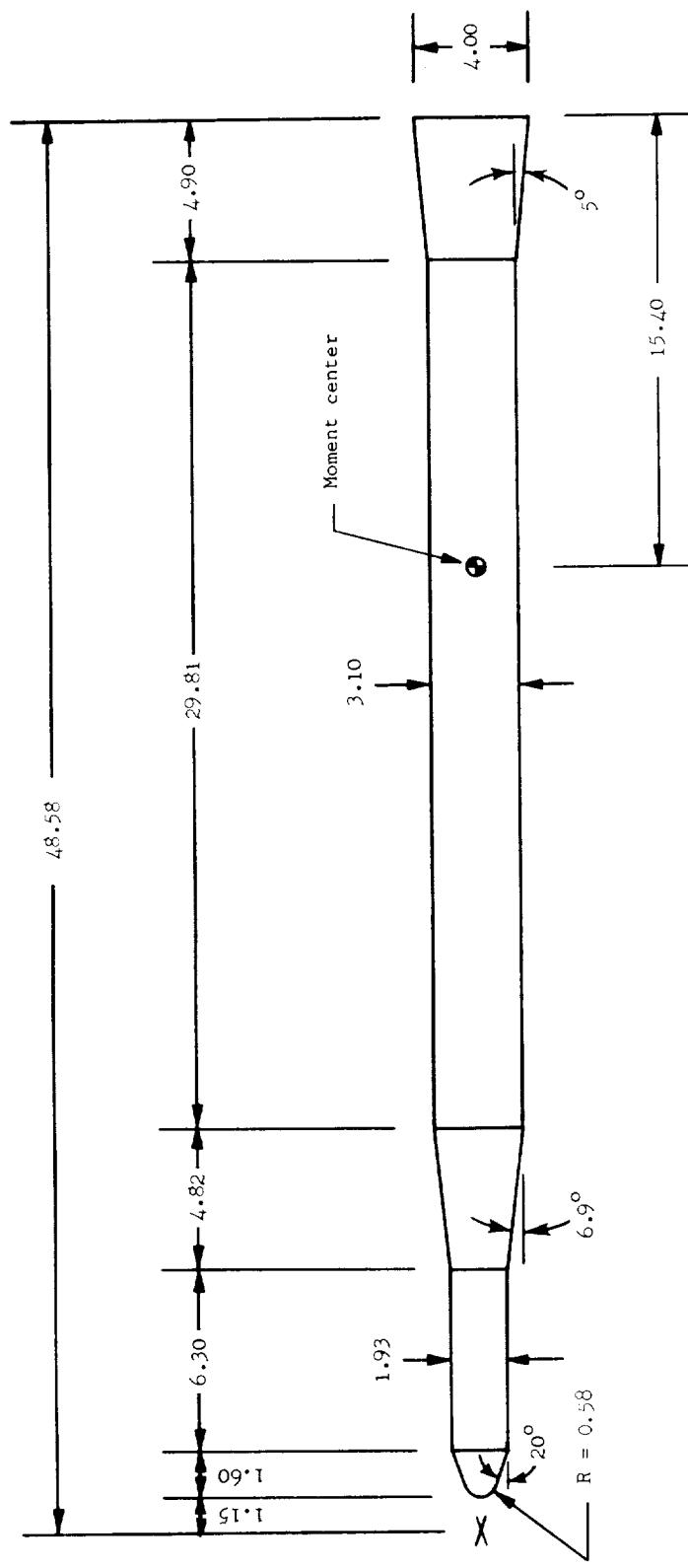


Figure 1.- Drawing of 1/10-scale model of a three-stage Scout vehicle. Dimensions are in inches unless otherwise noted.

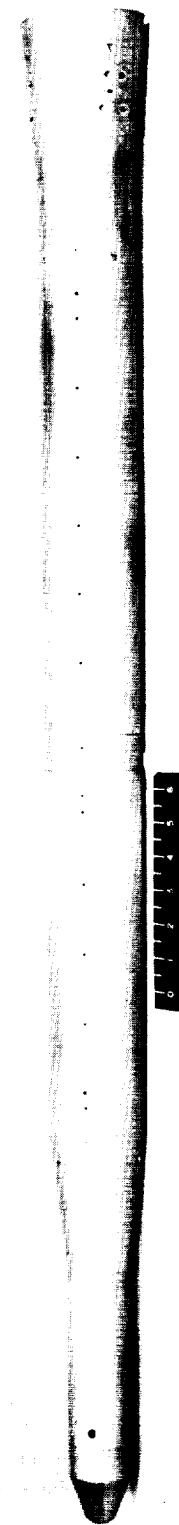


Figure 2.- Photograph of the model.

L-59-6356

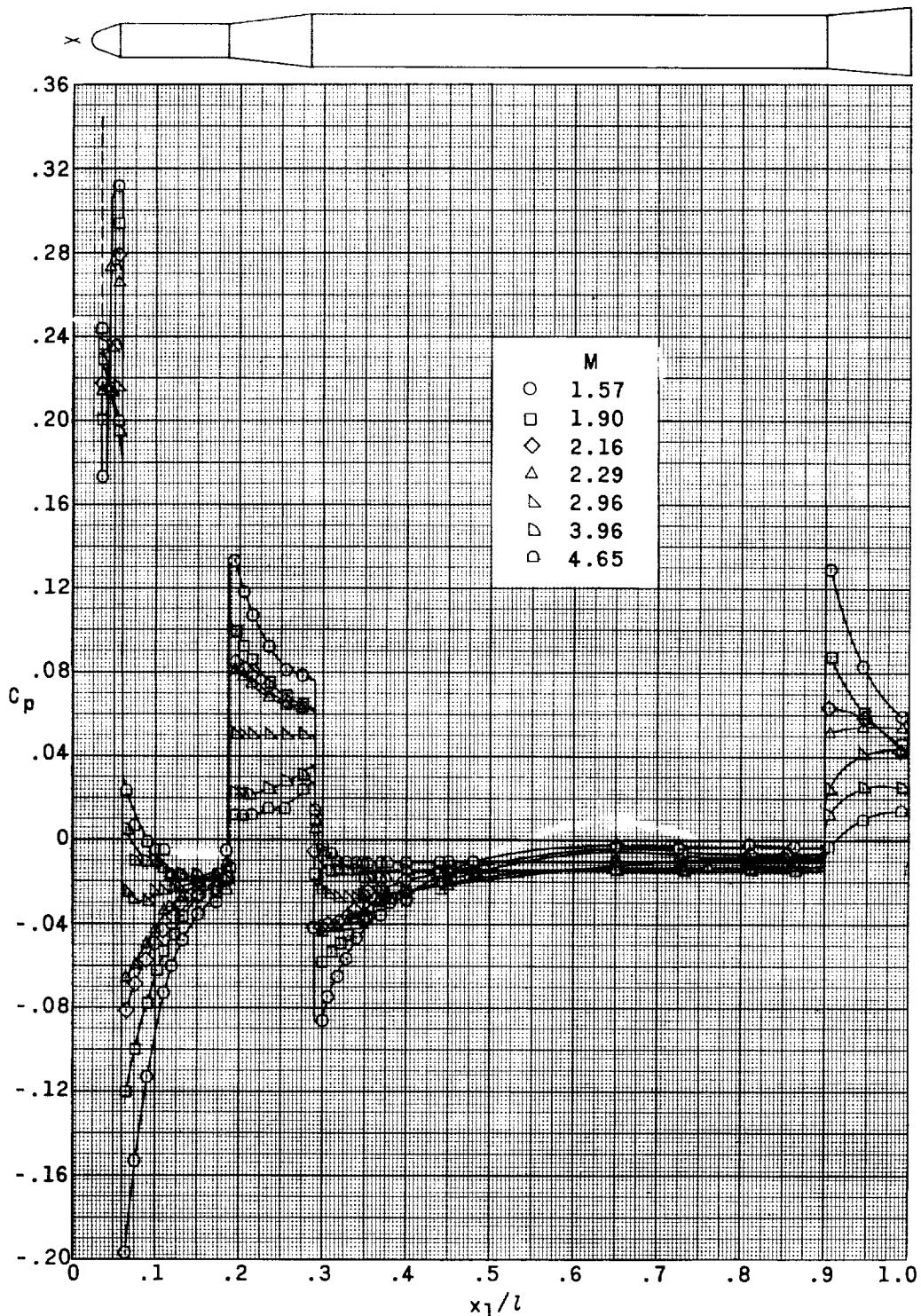
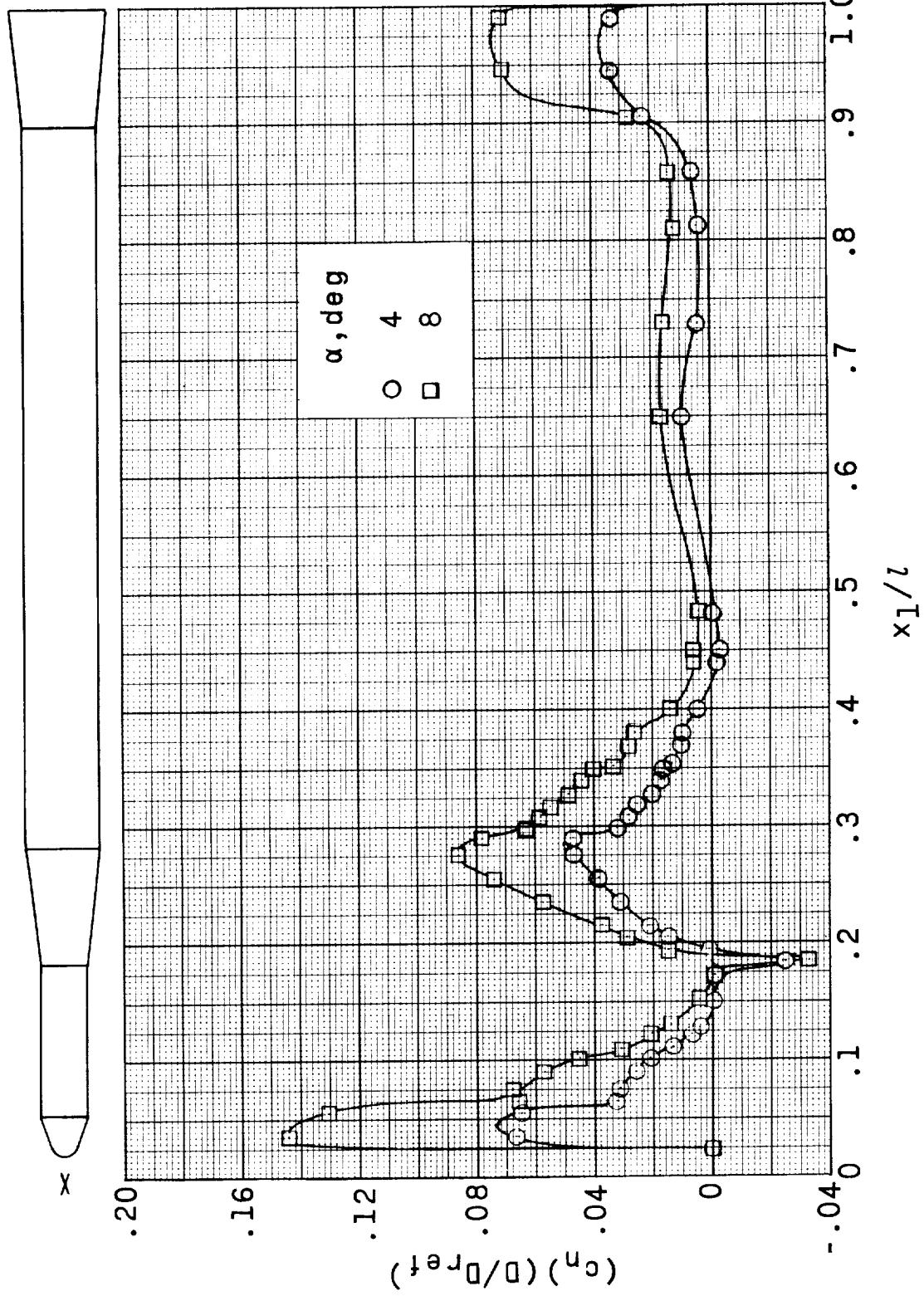
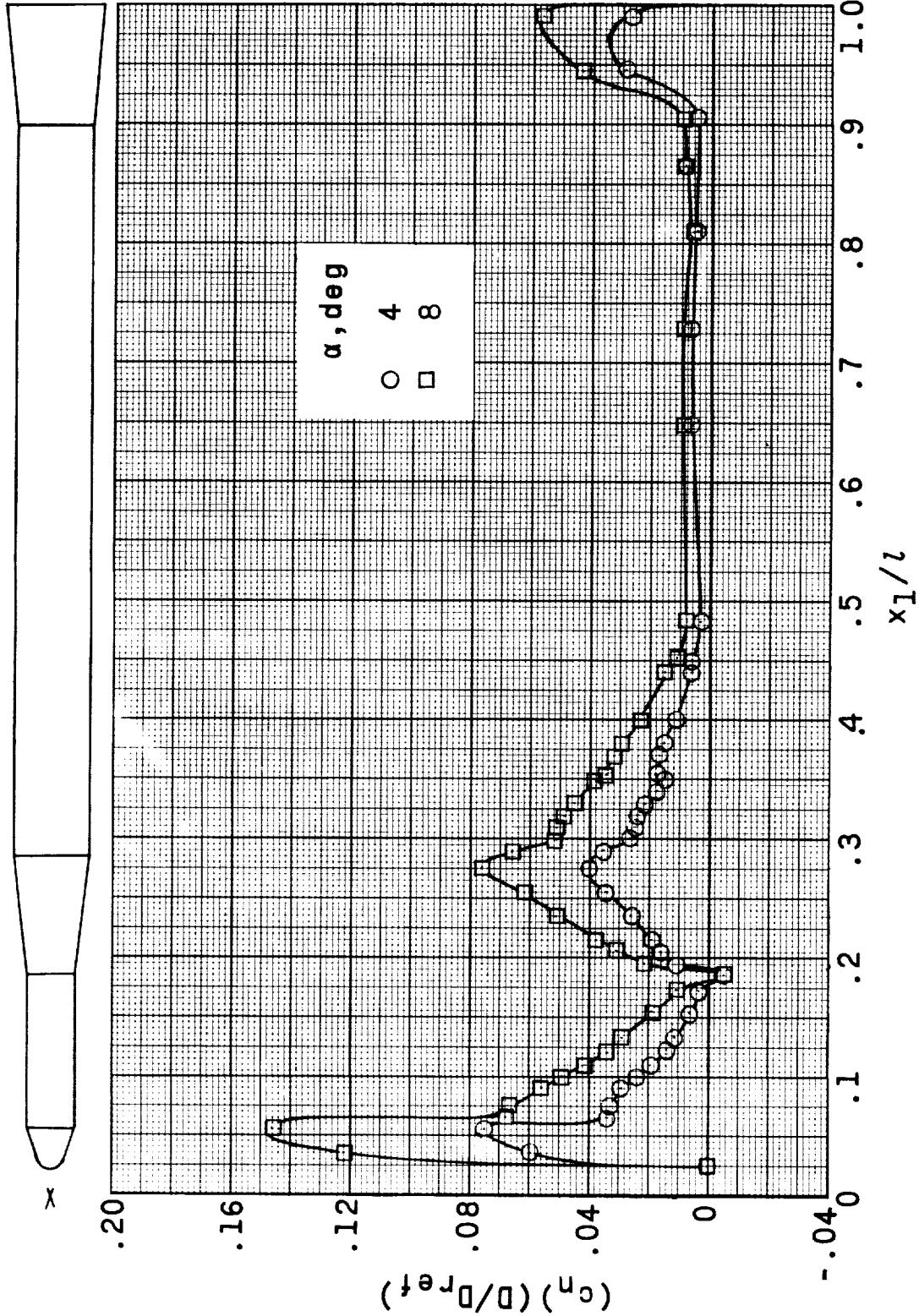


Figure 3.- Longitudinal variation of pressure coefficient at $\alpha = 0^\circ$ for 1/10-scale model of a three-stage Scout vehicle.

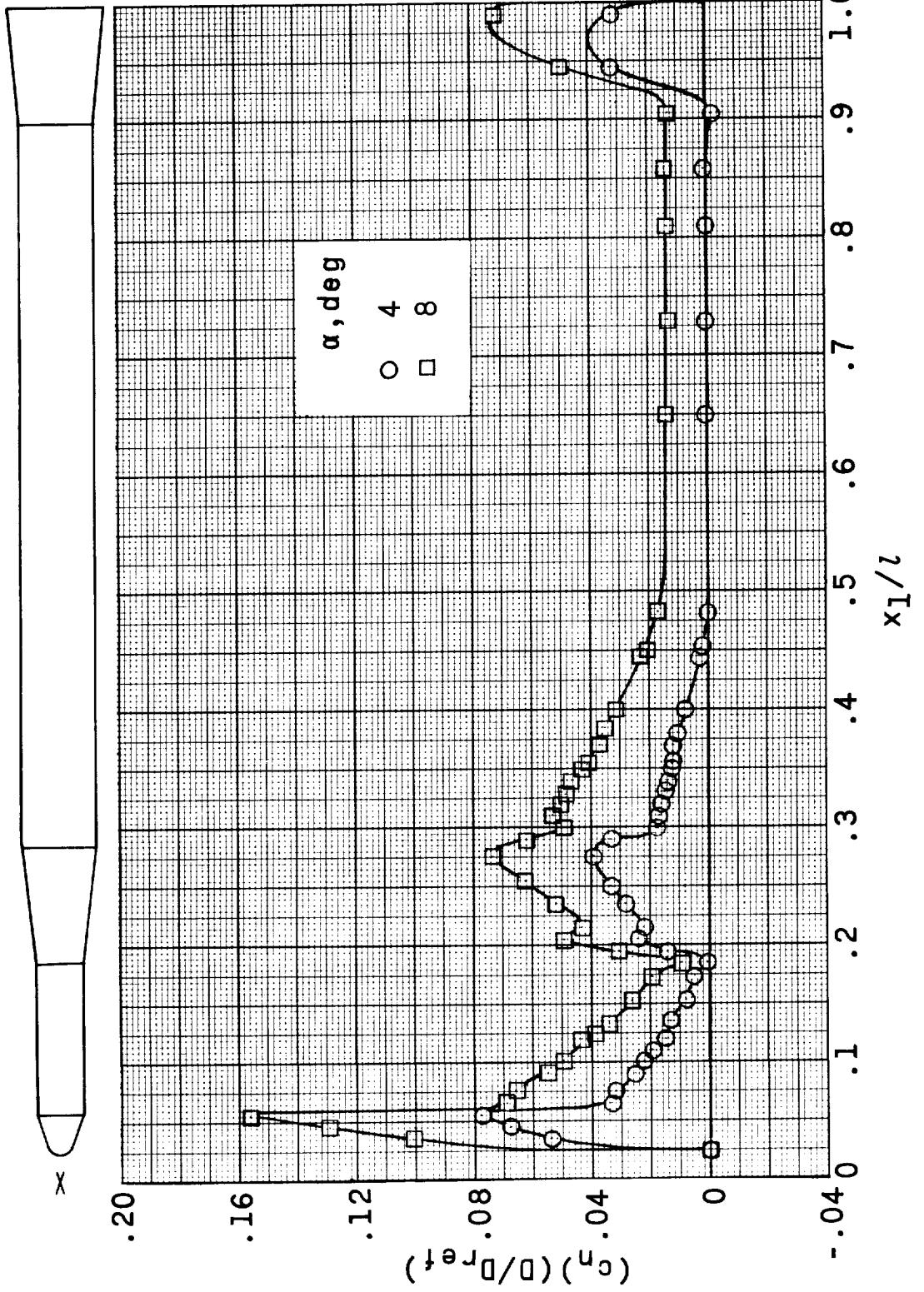


(a) $M = 1.57$.
Figure 4.- Longitudinal variation of body section normal-force coefficient for 1/10-scale model of a three-stage Scout vehicle.



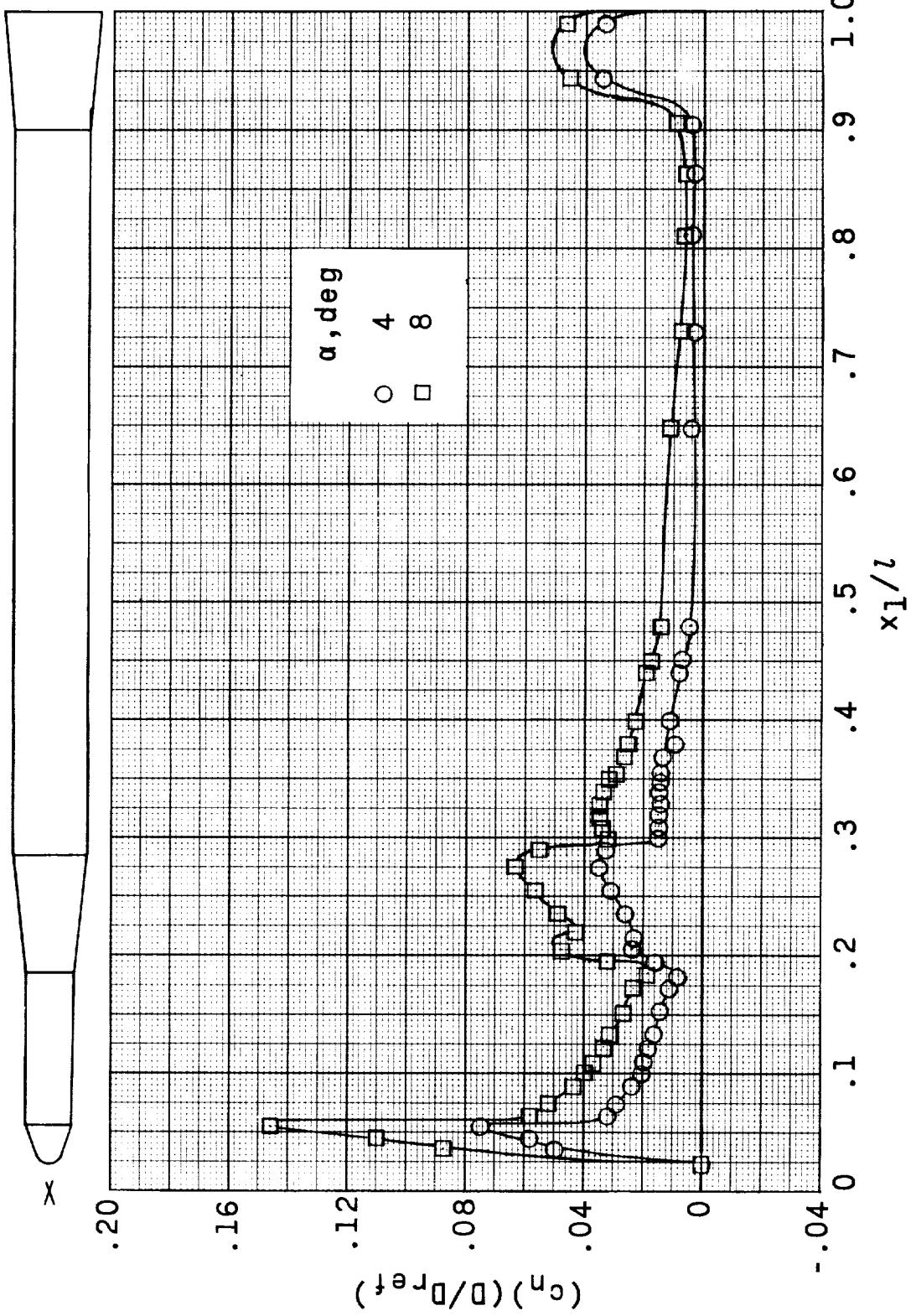
(b) $M = 1.90$.

Figure 4.- Continued.



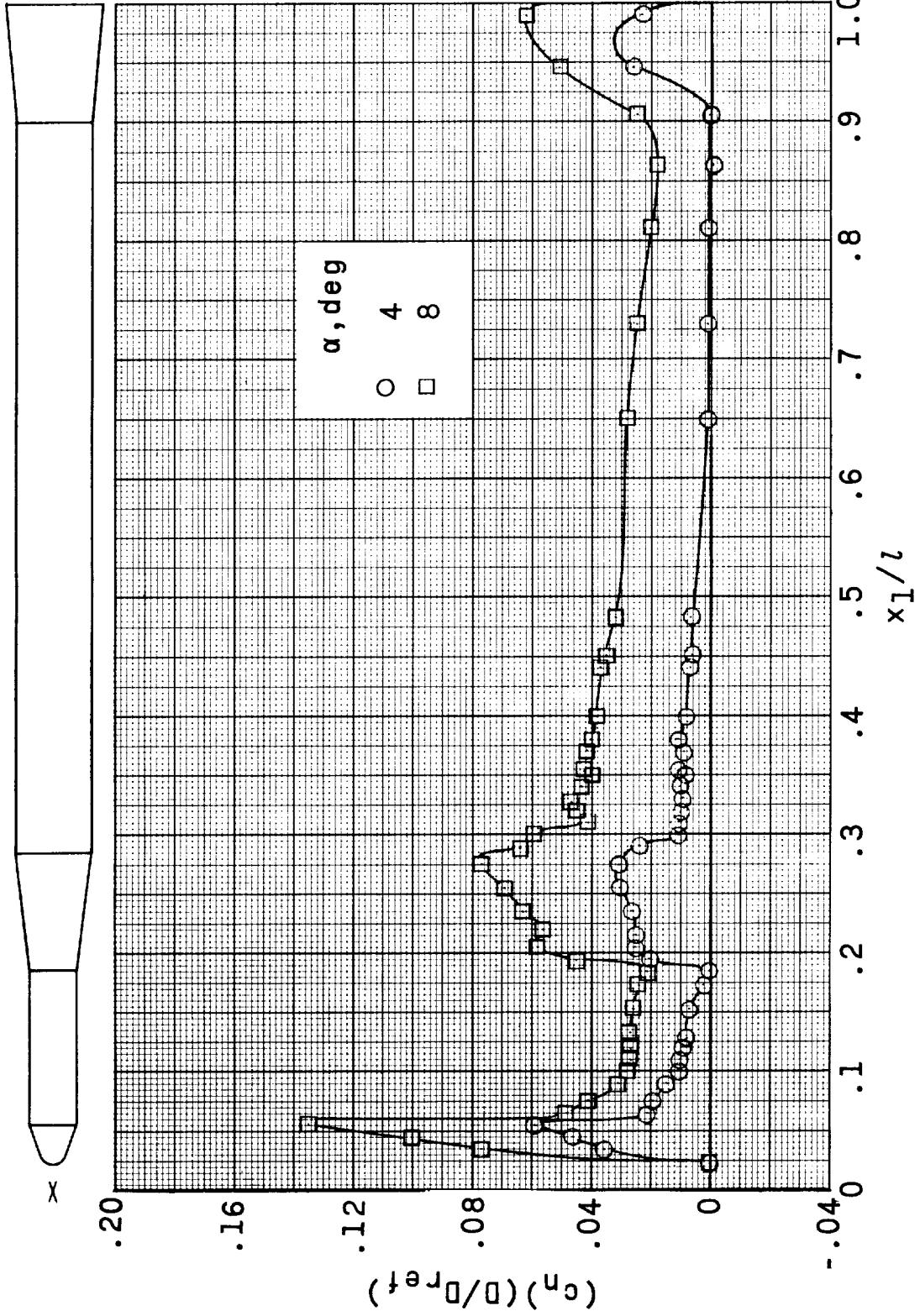
(c) $M = 2.29$.

Figure 4--Continued.

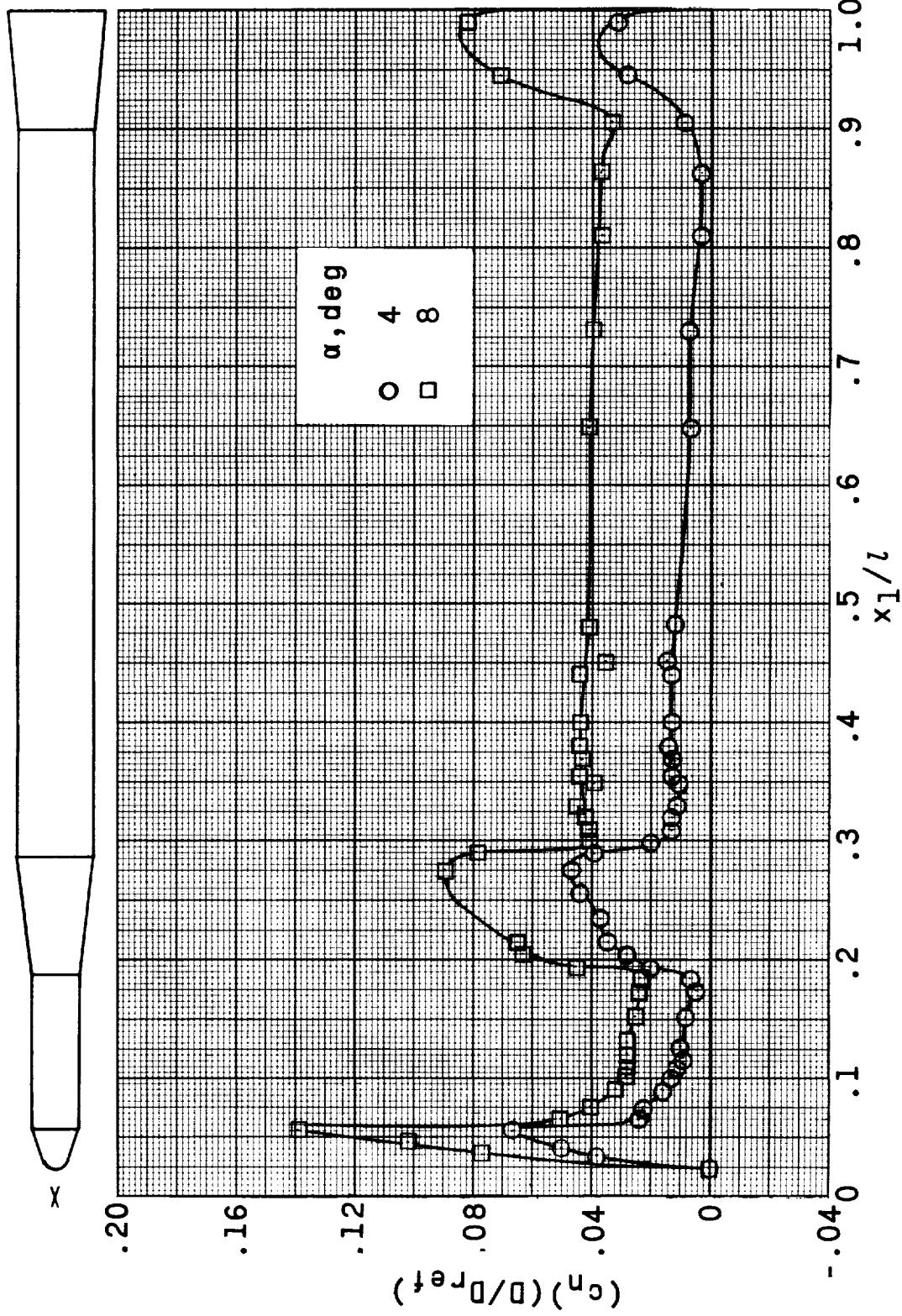


(d) $M = 2.96$.

Figure 4.- Continued.

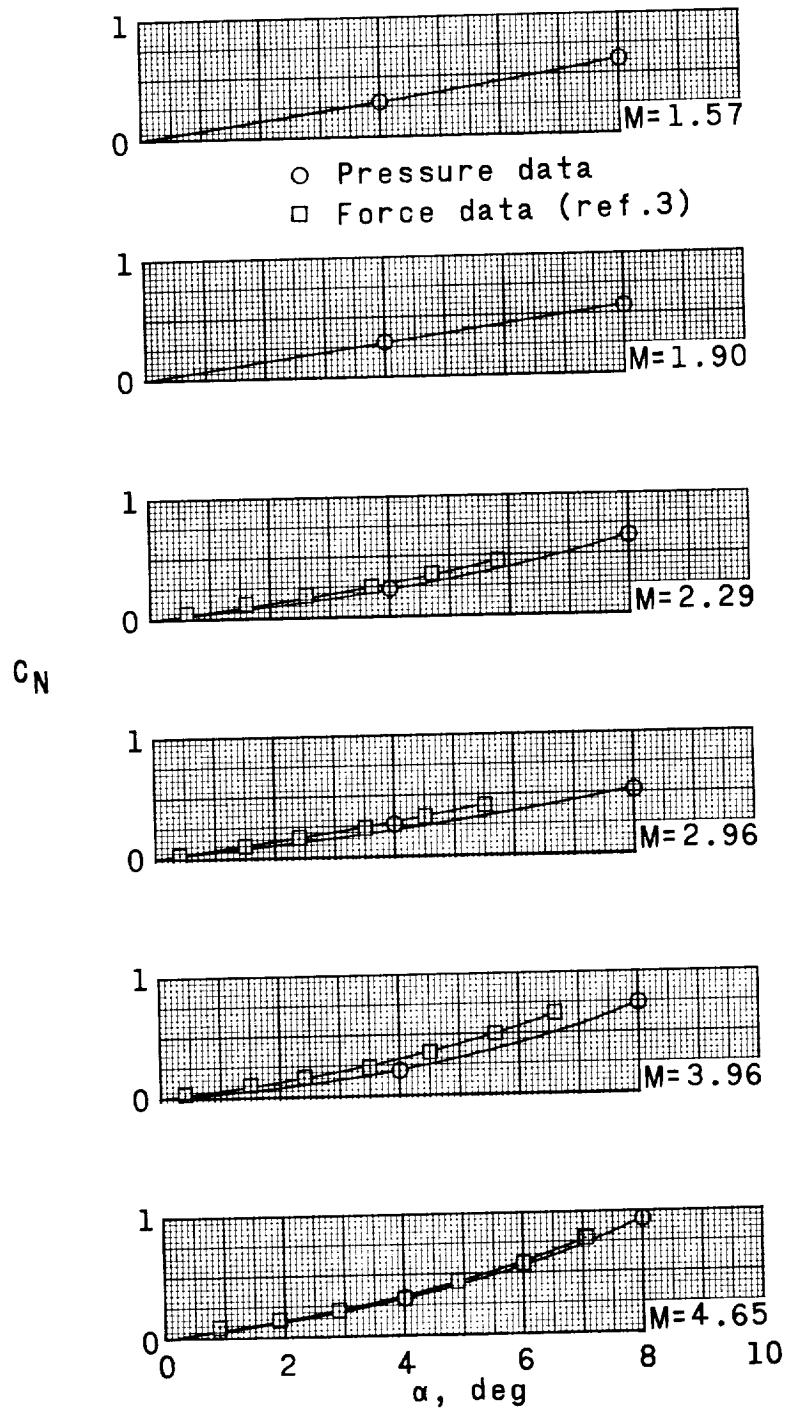


(e) $M = 3.96$.
Figure 4.- Continued.



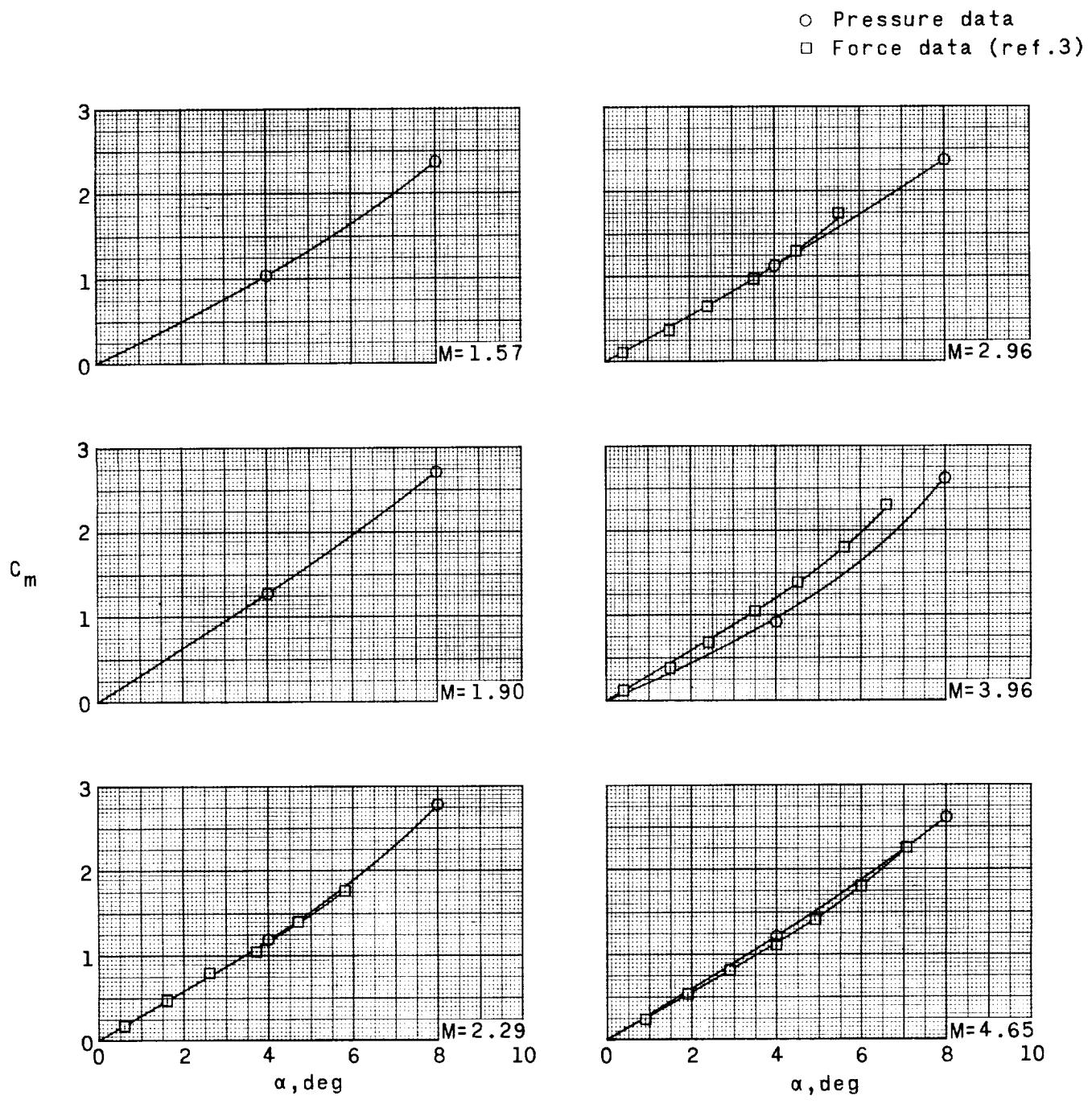
(f) $M = 4.65$.

Figure 4. -- Concluded.



(a) Normal-force coefficient.

Figure 5.- Normal-force and pitching-moment coefficients for 1/10-scale model of a three-stage Scout vehicle.



(b) Pitching-moment coefficient.

Figure 5.- Concluded.







